

Notice of Allowability	Application No.	Applicant(s)	
	09/866,890	COPELAND ET AL.	
	Examiner	Art Unit	
	Abolfazi Tabatabai	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to application filed on May 29, 2001.
2. ☒ The allowed claim(s) is/are 1-36.
3. ☒ The drawings filed on 29 May 2001 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date <u>5/29/01</u> | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
2. The application has been amended as follows:
3. In specification, page 1, line 5, after 2000, insert--- now U S Pat. No. 6,701,028 B1 dated March 2, 2004---.

Reasons for Allowance

4. The following is an Examiner's statement of reasons for allowance.
 The prior art of record fails to teach or suggest, method and apparatus for fast signal convolution using separated-spline kernel comprising (a) specifying the separated-spline kernel as $k(x_1, \dots, x_n) = k_1(x_1) \dots k_n(x_n)$, where k_j has circulant K_j , $k(x_1, \dots, x_n)$ admits of an operator $A = A_1 A_2 \dots A_n$, and A_j is an annihilation or flattening operator which operates on the circulant K_j of kernel K_j in such a manner that $A_j K_j$ is sparse (when A_j is an annihilation operator) or $A_j K_j$ is almost everywhere a locally constant matrix (when A_j is a flattening operator); processing pattern data indicative of the pattern p and kernel data indicative of the kernel k_1 , to generate additional data indicative of $q_1 = A_1 k_1 x p$ for each row of the pattern p ; processing the additional data to backsolve $A_1 r_1 = q_1$ for said each row of the pattern to determine data indicative of $r_1 = k_1 x p$ for said pattern, by performing a preliminary ignition step in which

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a small number of components of r_1 are computed directly, and then determining all other ones of the components of r_1 using a natural recurrence relation determined by the operator A_1 ; processing the data indicative of $r_1 = k_1 \times p$ to generate data indicative of $q_2 = A_2 k_2 \times (k_1 \times p)^T$ for each row of $(k_1 \times p)^T$, where $r_1^T = (k_1 \times p)^T$ denotes transposition of r_1 ; and (e) processing the data indicative of $q_2 = A_2 k_2 \times r_1^T$ to backsolve $A_2 r_2^T = q_2$ for said each row of $(k_1 \times p)^T$ thereby determining data indicative of $r_2^T = (k_2 \times k_1 \times p)^T$ for said pattern p in combination into other features and elements of claims 1, 23, 25, 27, 33 and 36; (b) specifying the separated-spline kernel as $k(x,y) = k_1(x) k_1(y)$, where $k_1(x) = (R^2 - x^2)$ for $|x| \leq R = cd^{-|x|}$ for $|x| > R$, and where the kernel $k_1(x)$ satisfies: $k_1(x) = k_c(x) + k_+(x) + k_-(x)$, where $k_c(x)$ is a kernel $k_c(x) = (R^2 - x^2)$ for $|x| \leq R = 0$ for $|x| > R$, $k_+(x)$ is a one-tailed Laplacian kernel $k_+(x) = cd^{-|x|}$ for $|x| > R = 0$ for $|x| \leq R$, and $k_-(x)$ is a one-tailed Laplacian kernel $k_-(x) = cd^{-x}$ for $|x| < -R = 0$ for $|x| \geq R$ in combination into other features and elements of claim 9; (c) specifying the separated-spline kernel as $k(x,y) = k_2(x) k_2(y)$, with $k(x,y)$ approximating the kernel d , where $k_2(x) = 2\cos^2(\pi x/2R)$ for $|x| \leq R$, and $k_2(x) = 0$ for $|x| > R$ in combination into other features and elements of claim 15.

5. Claims 1-36 are allowed.

6. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on

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Statement of Reasons for Allowance."

Citation of Relevant Prior Art

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Simonds (U S 4,918,742) discloses image processing using multi-pass convolution with small lernels.

Politis (U S 6,580,836 B2) discloses a scan line rendering of convolutions.

Landa (U S 5,151,953) discloses a single chip 2-D convolver.

Hounder (U S 5,917,961) discloses an image convolution using pre-calculated look-up tables.

McCoy (U S 5,926,580) discloses a convolution algorithm for efficient hardware implementation.

Contact Information

8. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to ABOLFAZL TABATABAI whose telephone number is (703) 306-5917.

The Examiner can normally be reached on Monday through Friday from 9:30 a.m. to 7:30 p.m. If attempts to reach the examiner by telephone are unsuccessful, the Examiner's supervisor, Mehta Bhavesh M, can be reached at (703) 308-5246. The fax phone number for organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published

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applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Abolfazl Tabatabai

Patent Examiner

Group Art Unit 2625

March 1, 2005

A-Tabatabai

K. Patel
KANJIBHAI PATEL
PRIMARY EXAMINER